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ABSTRACT

Three members of the Ohio State University Astronomy department developed an audiovisual program in Astronomy to provide a format for more active student participation than is possible in large lecture sessions. The program consists of 18 filmstrip/cassette modules and an integrated textbook which were utilized on an individual basis, allowing students to repeat material prior to instructor meetings. The formative evaluation design, pilot testing, and procedures are provided, as well as the results of a study comparing student reactions and achievement in experimental groups employing this program with those in traditional lecture sections of the course. (RAO)

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IMPLEMENTATION AND VALIDATION OF A NEW COURSE IN INTRODUCTORY ASTRONOMY AT THE COLLEGE LEVEL

by

Alan D. Evans

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Implementation and Validation

Of A New Course

In Introductory Astronomy At The College Level

Alan D. Evans

The teaching of a university introductory Astronomy course at the cultural level suffers from two major drawbacks, namely, the large diversity in the backgrounds of the students, and, the lack of opportunity for discussions in large lecture sections. The variation in student background, itself, is a strong deterrent to discussion since the less knowledgeable student often has no basis for participation. In searching for a method permitting more active student participation, rather than passive reception of lectured material, three members of The Ohio State University Astronomy department developed an audiovisual program in Astronomy.

The program consists of eighteen audiovisual modules and an integrated textbook. Each audiovisual module consists of a film strip containing roughly 45 frames and an audio tape of about 35 minutes duration.[1] Since the program was designed for a one-term presentation, the audiovisual modules can be assigned for study at a rate of one to two per week. The modules, utilized on an individual basis, assume the burden of transferring large amounts of factual information. This frees the course instructor to devote attention to developing and integrating the basic concepts in the course. The audiovisual modules have the advantage of allowing a student with a deficient background to repeat material and to develop the necessary background prior to meeting with the instructor.

1. Protheroe, W.M., E.B. Capriotti, and G.H. Newsome. Astronomy. Charles E. Merrill. Columbus, Ohio.

This author teamed with the three authors of the program, Astronomy, to implement a new method of teaching the introductory Astronomy course. The team needed to know how this new approach to teaching the course affected student learning as compared to sections taught by a traditional lecture method. It was also desirable to know what student reaction would be to the new teaching method. The subjects were freshmen, sophomores, juniors and seniors who had elected to take Astronomy 150 as part of a physical science requirement.

FORMATIVE EVALUATION

In designing an evaluation procedure the first goal was to gather data of a formative nature. Formative evaluation was applied in the sense used by Scriven.[2] That is, evidence was collected while the course was under development, and while revision was practical. All the faculty involved in the project participated in collecting and analyzing data and revising their instruction accordingly. For example, as first offered, weekly activity in the course consisted of one lecture, two audiovisual modules, a recitation and an optional help session. Feedback from students and faculty resulted in a change to two meetings per week to accomodate two lectures corresponding with the two audiovisual modules and to allow time for a weekly quiz. The optional help session was dropped because of low student attendance and the faculty members' belief that questions could be adequately handled in the recitation.

PILOT

To begin the formative evaluation and to initially determine effectiveness of the audiovisual modules a pilot program was conducted during Summer, 1976. In place of five lectures per week given in the traditional Astronomy course, students

2. Scriven, M. The Methodology of Evaluation, AERA Monograph Series on Curriculum Evaluation, 1967.

attended one lecture, one recitation, viewed two sound filmstrips and optionally attended one of two help sessions. This instructional strategy was intended to transfer the burden of basic content presentation from professor to filmstrip, thereby allowing him time and energy for qualitative interaction with students in smaller recitation and help sessions. The individual use of sound filmstrips also provided students with the ability to control their rate of study.

The results of this pilot program were assessed in three ways: student questionnaire, professor's observations, and final course grade. When surveyed, 82% of students indicated the audiovisual modules were helpful. They suggested ways to make the modules more accessable, and as mentioned previously, favored two lectures per week.

The professor observed:

> By not having to meet the class for five hours of formal lecture a week, it became possible to devote more personal attention to the students, either in small recitation groups or in individual consultation. The very structuring of the course seemed to encourage the students to seek more individual meetings than I have experienced in former quarters when I taught 150 by the lecture method.[3]

The average grade point for the pilot program in the Summer, 1976 was 2.42 as compared to 2.39 for a lecture approach during the previous Summer. This was a promising if not a significant increase in learning and was reinforced by fewer failures and fewer students dropping the course. With these results the University's administration provided financial support and encouragement for a comparative study of the lecture and audiovisual methods.

PROCEDURE AND RESULTS

To determine the effectiveness of the new course a research design was established in which each of three professors taught a section by the experimental

3. Protheroe, W.M., Professor's written evaluation of pilot program.

method, and, another by the standard lecture method. These sections along with the quarter offered and the enrollments are listed in Table I.

The first phase of the evaluation plan was an end-of-quarter survey of students in the audiovisual and lecture sections concerning their opinions of the course they had taken. There were 690 students involved during the three quarters; 290 in three audiovisual sections, and, 370 in three lecture sections. Results of this survey were as follows:

1. The subject matter for this course was presented in a well organized manner.

	Favorable	Unfavorable
AV	86.2%	13.7%
LECTURE	90.6%	9.4%

2. This course compares favorably with other courses I am currently taking.

	Favorable	Unfavorable
AV	63.9%	36.1%
LECTURE	69.5%	30.6%

3. Overall, I view my experience with this course favorably.

	Favorable	Unfavorable
AV	75.2%	24.8%
LECTURE	80.0%	20.0%

4. I have developed an interest in astronomy as a result of my experience with this course.

	Favorable	Unfavorable
AV	74.9%	25.1%
LECTURE	78.1%	21.9%

Written comments on the student questionnaire were largely positive. Many students indicated they found the self-pacing aspect extremely helpful. A small minority disliked use of the audiovisual equipment and wanted five lectures per week by a "live" faculty member.

For students in the audio visual sections, several additional questions

relating to the use of the audiovisual modules produced the following responses:

1. Did you find the audiovisual modules helpful in your understanding of the course material?

   yes 79.3% no 20.7%

2. What is your general reaction to this particular instructional program?

   very favorable 25.4% favorable 51.5%
   unfavorable 16.2% very unfavorable 6.9%

Overall, the students in lecture sections responded slightly more favorably than those in audiovisual sections. Never-the-less, the student reaction to the audiovisual modules was very positive.

The second phase of the evaluation plan compared the grade point averages of the audiovisual and lecture sections. Table 2 shows the percentage grade distribution for the two groups of students. The average scores, on a 4.0 basis, were 2.526 ± 0.068 and 2.377 ± 0.064 for the audiovisual and lecture sections respectively. The hypothesis that students in the audiovisual sections would achieve a higher final grade point average, was substantiated. The null hypothesis was rejected with a 93% level of confidence.

DISCUSSION

It is clear that students in the revised course using audiovisual media performed better on exams. This is seen statistically and in the table 2 showing letter grade distribution. On the other hand, the lecture sections had a slightly higher percent of student approval. This is not too surprising when one considers the added responsibility students had to assume with the audiovisual system. A major plus was a reduction of faculty contact hours in large lecture situations with a corresponding increase in quantity and in quality of interaction between professor and students at other times. A number of students with low grade point averages gave strong approval to the use of individual modules which allowed self-pacing. However, no advantage for this group could be statistically

established. And finally, there was the small minority of students who expressed dislike for all audiovisual equipment and preferred live lectures.

The effect of this program has been so beneficial to many students it has been continued. Currently, the basic Astronomy course is offered in lecture format as 150 and in the audiovisual format as 150A. Students are guided by counselors to select the format they prefer.

TABLE I

	Experimental (AV Modules)	Control (Lecture)
Professor A	Autumn Quarter Enrollment 133	Winter Quarter Enrollment 111
Professor B	Winter Quarter Enrollment 87	Autumn Quarter Enrollment 125
Professor C	Spring Quarter Enrollment 87	Autumn Quarter Enrollment 183

TABLE II. PERCENTAGE GRADE DISTRIBUTION

Grade	Audio-Visual	Lecture
A	19.4%	16.9%
B	34.8%	31.8%
C	29.1%	30.2%
D	12.1%	14.3%
E	4.5%	6.8%